Space Weather Technical Forecast

Issued on Wednesday, 07 August 2024 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Further M-class flares expected with a chance of isolated X-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with an M1.8 at 07/230 from AR3774, just west of centre disc and an M1.1 from AR3781, in the northeast. There are ten regions on the visible disc, the largest of which is AR3780 in the southeast. This has been relatively inactive through this period, with only C-flares observed, and has only seen limited development within the proliferation of small spots to its south and west. However this has now also moved into a location where a very weak delta spot is evident in a small penumbral area following the main leader spot. Across the south-centre disc, AR3774 and AR377 showed ongoing growth in their small spots trailer spots, also including the development of very small and weak delta spots. The only other M-flare of the period was from AR3781 in the northeast, which has some slight flux emergence, but also the development of a small delta spot to its north.

CMEs were evident in imagery. These included one to the northwest, from the filament eruption north of AR3775 at around 07/0120 UTC, and a further CME off the southeast disc that had an unknown source location, but perhaps the C-flaring of AR3780. This C-flaring occurred coincidently with the M1.8 flare of AR3774, however this is likely too far west to be the source of this CME. Another CME was observed from over the northeast limb. These are all likely to miss, however glancing influences are possible from the northwest filament CME on day 4 (10 Aug).

Solar Wind / Geomagnetic Activity: Slow wind conditions persisted through the period. Solar wind speeds, as measure by ACE at L1, eased from slightly elevated to background, from just over 400 km/s to just below. Density remained at or below average. Interplanetary Magnetic Field, Bt, was Weak, below 6nT, while the north-south component was Weak and variable in direction, between -6nT and +6nT. Phi angle was negative (towards the Sun). Geomagnetic activity remained Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained below the S1 Minor Radiation Storm threshold, but was initially slightly elevated following the X1.7 flare from the west limb on 05 Aug. This soon declined to background again. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background. The 24-hour fluence was below the Active threshold with 1.32e6 integrated pfu observed at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High solar activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs, although the filament eruption CME which left the Sun on 07 Aug is expected to pass close later on day 4 (10 Aug), with glancing influence possible. Background slow winds are expected throughout with just a slight chance of connecting to any fast wind from the small positive polarity coronal hole 57 by the end of the period. Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled

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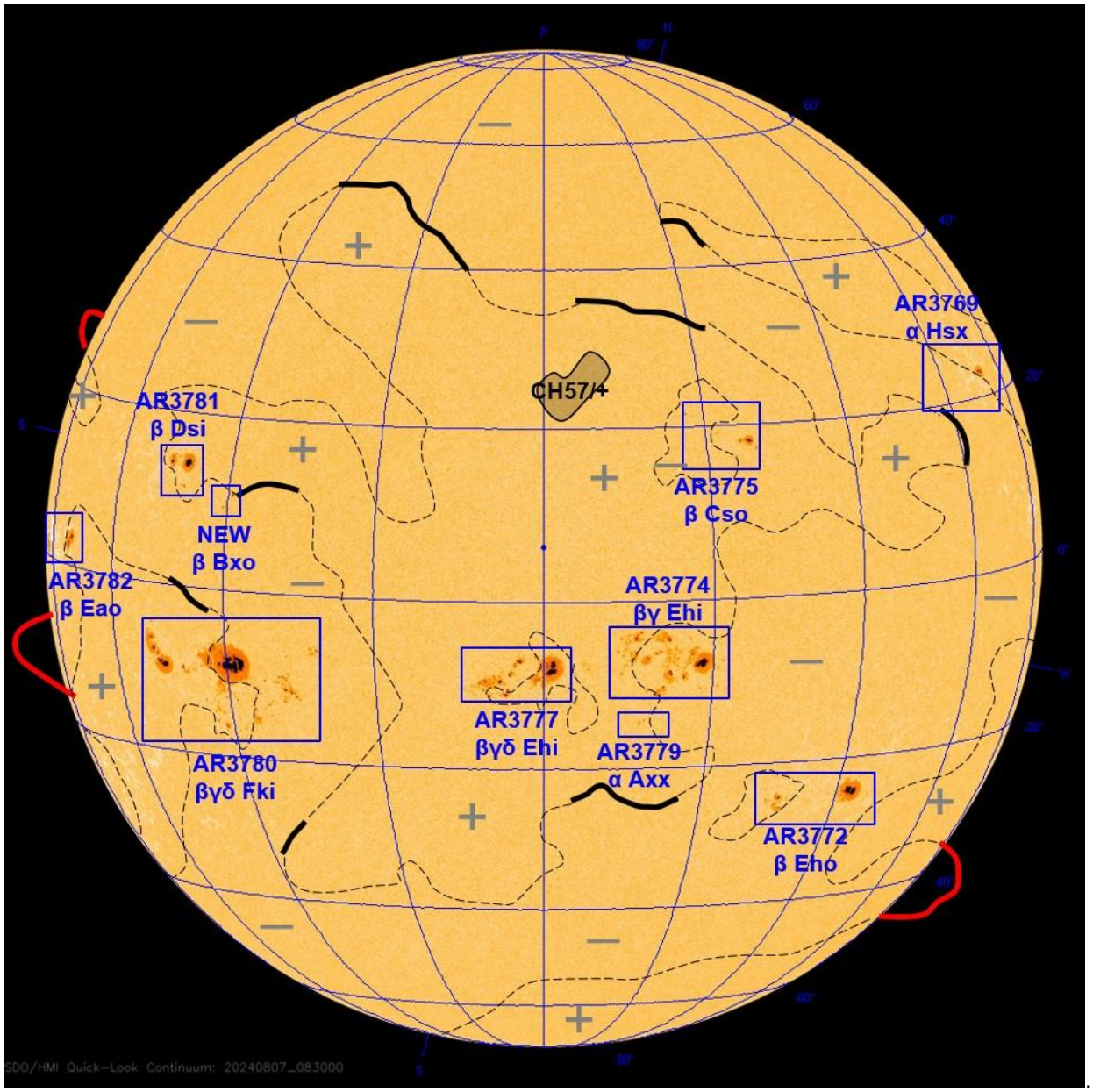
intervals, but a slight chance of Active to G1 Minor storms by the end of the period from any CME glance or coronal hole onset.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist around background levels. Should any further notable flares occur, especially in the western disc, there is the potential for flux to rise further with a slight chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be at mostly background levels. The associated 24-hour fluence is expected to remain below the Active threshold (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 07/0800.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs expected, however given the number of CMEs that have occurred off the Earth-Sun line in recent days, some slight transient glancing effects cannot be completely ruled out, especially later in the period. These perhaps most likely from the filament eruption from the northwest disc, just north of AR3775, which is expected to miss, but pass close to Earth later on day 4 (10 Aug).

The next coronal hole fast wind enhancement is likely to be from any influence of CH57/+. Despite being a recurrent hole, and large on the previous rotation, no notable enhancement was observed on its previous passage. However there remains a slight chance of a connection, with winds increasing towards the end of day 4 (10 Aug), or more likely, beyond this forecast period.

Geomagnetic activity is expected to be largely Quiet overall, with a chance of isolated Unsettled intervals. However there is a slight chance of Active to G1 Minor Storms later in the period from any passing transient CME influence or coronal hole onset.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: MOSWOC persistence model, showing no significant enhancements expected.

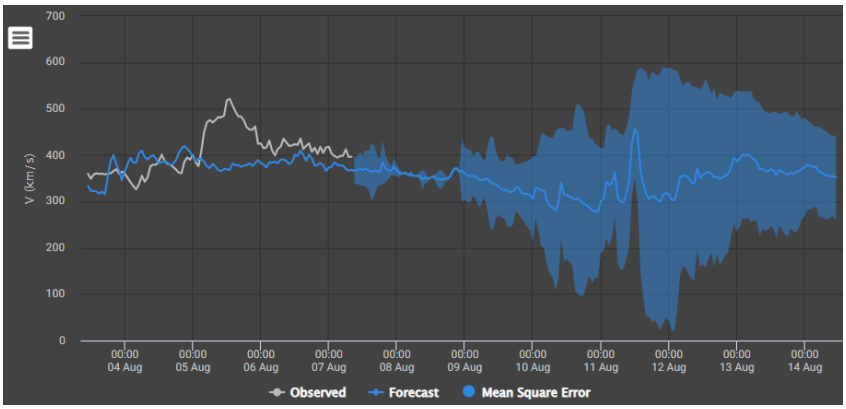

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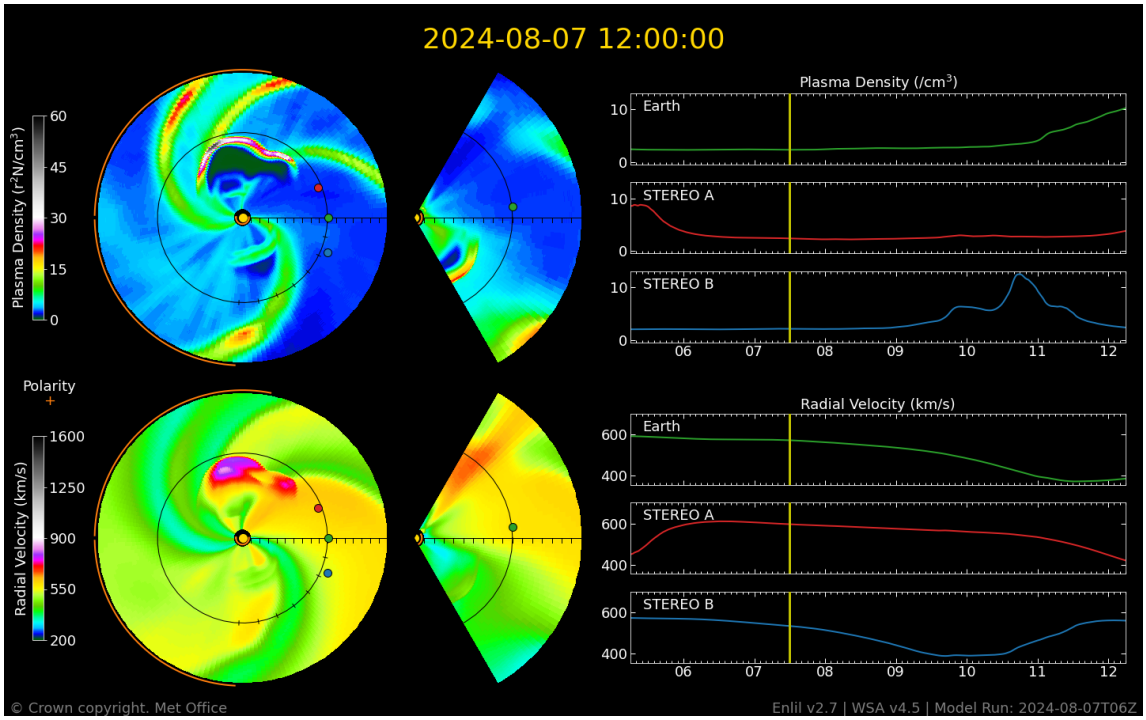
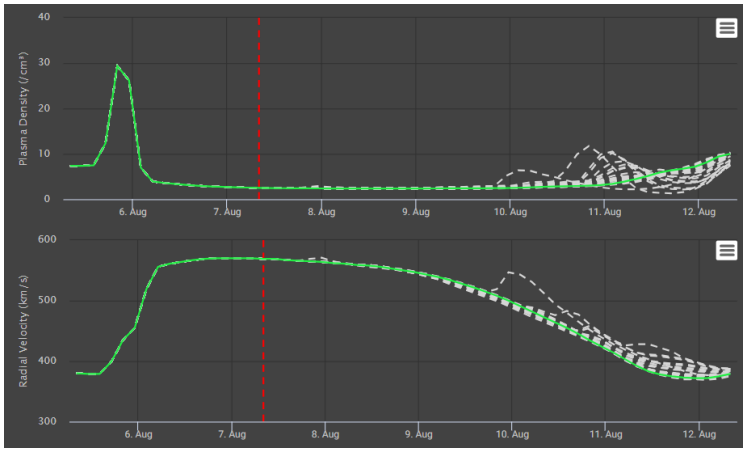
Figure 2b: Enlil and ensemble, showing CME missing on 10th. However Enlil has a poor representation of current conditions with an anomalous coronal hole fast wind.





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Radio Blackouts - X-Ray Flares:

Moderate to High activity is expected with occasional M-class flares expected and a chance of isolated X-class flares.

There are ten sunspot regions on the visible disc. AR3780 remains the largest region on the disc, with a large negative leader spot, but also a proliferation of small spots amongst a broad area of plage to its south and southwest. The region has limited complexity, however there is a small and very weak delta spot evident on a penumbral area to the west of its main leader. Just west of centre and in the centre disc respectively, AR3774 and AR3777 also consist of relatively large leader spots, followed by a number of smaller spots, although there are signs of these coalescing into a more definite trailer in AR3777. These regions also show signs of weak delta spot configurations. The other regions are smaller and simpler, however some small growth is evident in the small region AR3781 in the northeast, and this has produced the occasional M-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	80	80	80	80
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 3a: GOES-16/18 X-ray Flux

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Figure 3b: SDO imagery of AR3780

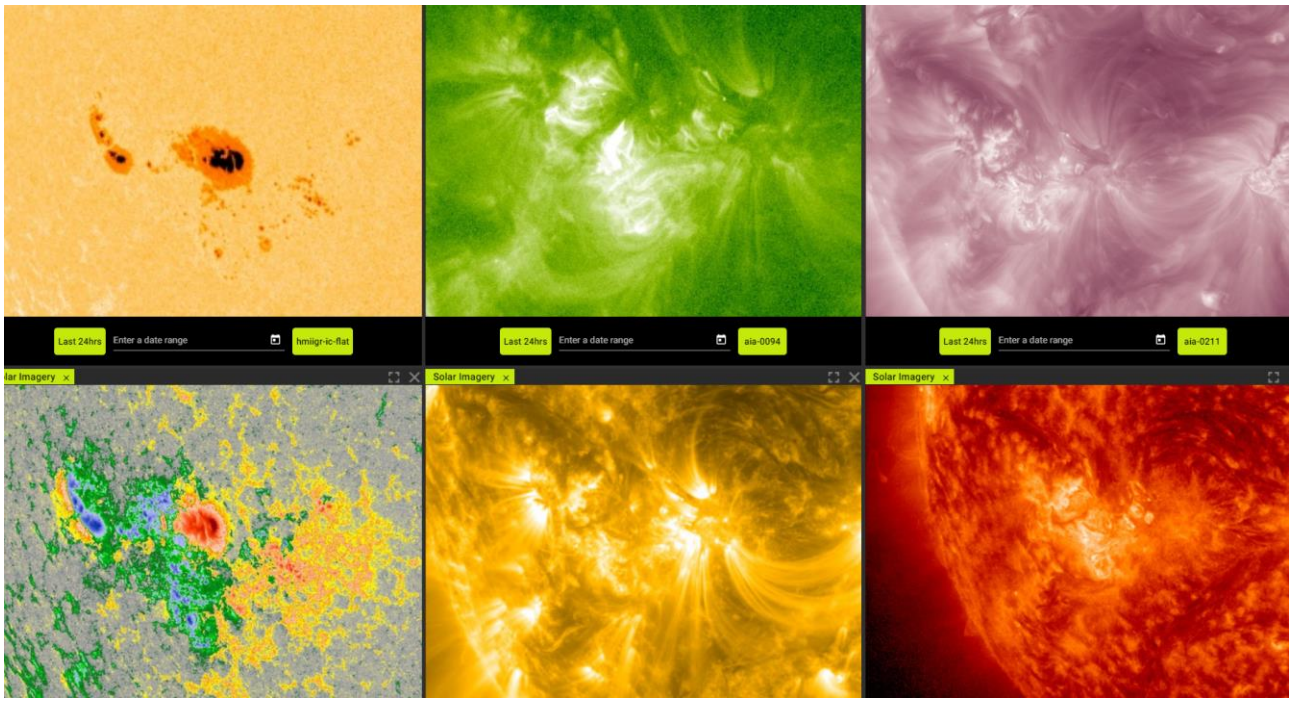
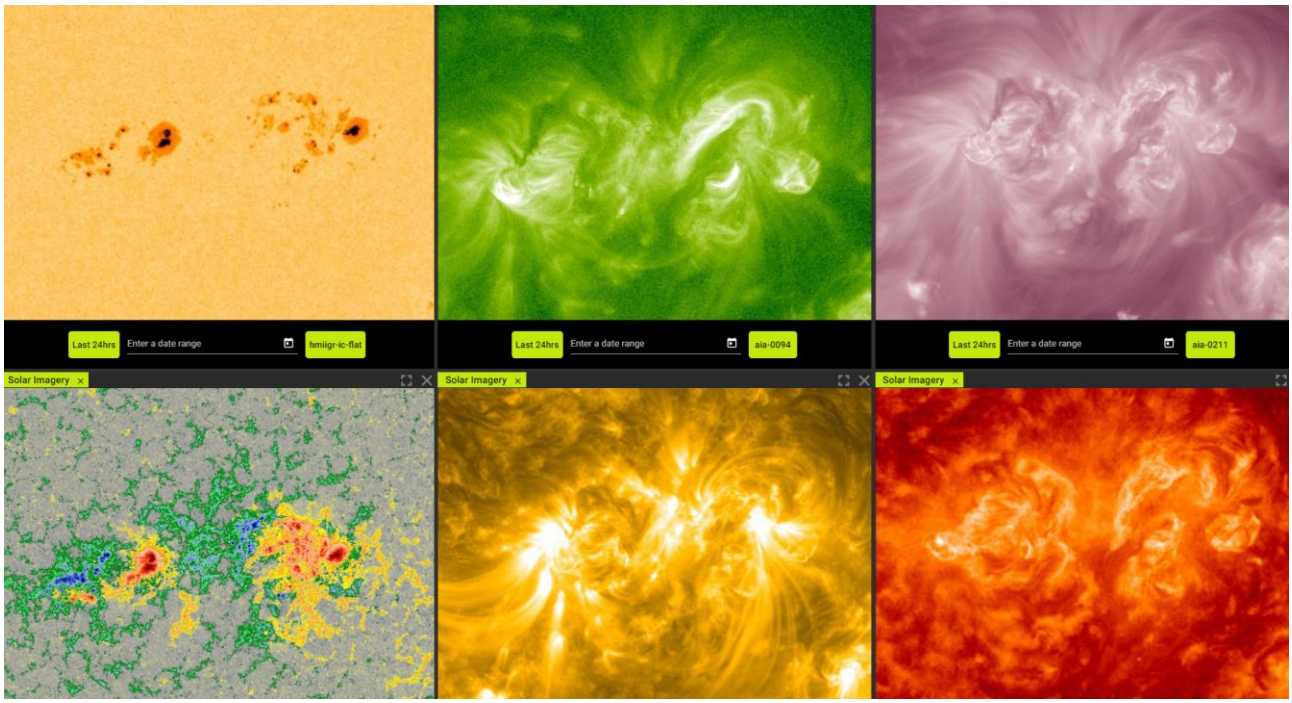


Figure 3b: SDO imagery of AR3777 and AR374



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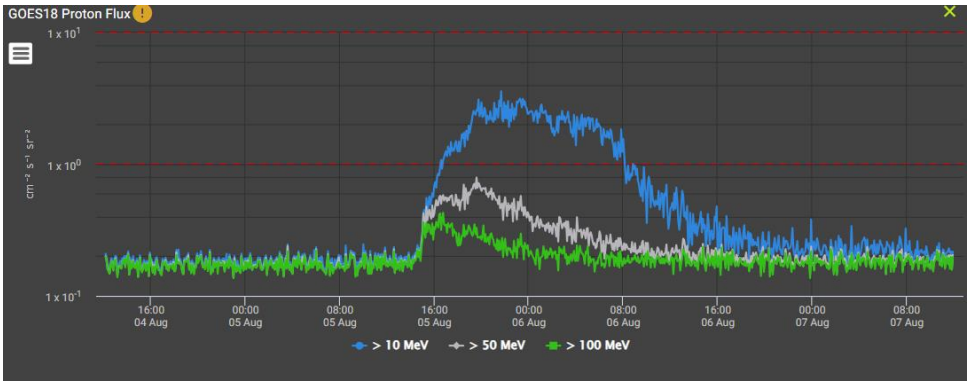
Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, was slightly raised, but below the S1 Minor Radiation Storm level at the start of the period, easing after the slight response to the X1.7 flare from ex-AR3767 on the west limb on 05 Aug. The proton flux continued to gradually ease to be near background at time of issue. Any further strong flares will bring the potential for a slight chance of reaching/exceeding the S1 Minor Radiation storm level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	20	20	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Last 72 hours GOES 18 >10 MeV, >50 MeV and >100 MeV Proton flux



High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, is currently at background. In the absence of any notable fast wind arrivals, the observed flux is expected to remain at or near background level.

The associated 24hr electron fluence is expected to remain below Active (1e8 integrated pfu).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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